

masses of cod, the object of the great winter and spring fisheries of Northern Norway. For this expedition the Norwegian Storting has already voted the necessary sum of money.
H. MOHN

NOTES

THE communications from Mr. Stanley in the *Telegraph* of Thursday and Monday last, though containing few positive additions to our knowledge, are full of interest; the episode on the arrival of the starved and wretched party at Ni Sanda is quite thrilling. Notwithstanding the number of cataracts and rapids on the Lualaba—Congo, Stanley maintains it is well fitted to become a great commercial highway—2,000 miles of uninterrupted water communication, opening up an extent of country embracing 600,000 square miles. North of the equator it receives a tributary 2,000 yards wide at its mouth, coming from a little north of east, and which, according to our present imperfect knowledge, is likely enough to be the Welle. Mr. Stanley speaks of the "infamous inaccuracy" of our present charts of West Africa, an inaccuracy which cost him the lives of many of his men, but which, no doubt, he will be able to correct. Three of Stanley's letters are dated from Nyangwe, and were written about a year ago. In them he speaks in the strongest language of the manner in which the slave-trade is carried on in that region, describes the wonderful forest scenery of the country between Tanganyika and Nyangwe, and gives some tender reminiscences of Livingstone preserved among the people, among whom the great traveller sojourned for so long. Mr. Stanley also endeavours to clear up the geography of the region between the Victoria, the Albert, and Tanganyika, showing that the most erroneous and confused ideas on the subject had been accepted mainly on the reports of natives to Sir Samuel Baker. No one now believes that the Tanganyika is connected with the Albert Nyanza, and, indeed, as Stanley suspects himself, he is, in refuting this notion, slaying the slain. From the little foretaste given us in these preliminary letters, there is no doubt that there is a rich feast in store for us of new and valuable information, and of adventure scarcely paralleled in the history of geographical exploration.

THE last number of the *Bulletin* of the Belgian Academy of Sciences contains details as to the plans of the Belgian expedition for the exploration of Central Africa, which is to leave Europe in the course of this month. Dr. Maes, of Hasselt, will accompany the expedition as surgeon and naturalist. The first Belgian station in Central Africa will be placed under the arrangement of Capt. Crespel, with whom Lieut. Cambier and Dr. Maes will be joined. The travellers will start for Zanzibar, and thence reach Lake Tanganyika, where it will be definitely settled whether a station be founded on the shores of the lake, or, a simple dépôt being left there, the station be fixed at Nyangwe, or elsewhere in Manyema. The Tanganyika, or Manyema, or Uyamwesi will become a basis for further scientific exploration; and agriculture will be carried on on the spot for the purpose of enabling the expedition to exist on its own resources.

WE would draw the attention of those of our readers who are interested in the matter to the announcement in our advertising columns with reference to the next distribution of the Government grant of 4,000*l.* Applications should be forwarded to the secretaries of the Royal Society before December 31.

VOL. VII. of the Royal Society's Catalogue of Scientific papers will be out in a few days.

THE *Gardener's Chronicle* hears that Signor Beccari is likely to succeed Prof. Parlatore as Director of the Herbarium and Botanic Garden at Florence, if arrangements can be made for some other Professor to undertake the duties of lecturing.

THE death is announced, on September 30, at the age of sixty-five, of Major-General Eardley-Wilmot, F.R.S., formerly chairman of the Council of the Society of Arts. At one time he was Director of Gun Factories at Woolwich, served on many Government committees on military matters, and was frequently consulted on scientific and educational subjects connected with the army.

THE Lords of the Admiralty have ordered that sets of the photographs taken during the Arctic Expedition of 1875-76 shall be presented to the British Museum, the South Kensington Museum, the United Service Institution, the Royal Artillery Institution at Woolwich, the Royal Engineer Institution at Chatham, and other Government or official institutions. Fifty sets only are to be prepared, and they will all be identical with the collection now on view at the Photographic Society's Exhibition, Pall Mall.

ABOUT eighty of the leading geologists of Germany assembled together in the annual meeting of the Deutsche geologische Gesellschaft, at Vienna, on September 27. Baron von Hauer, of Vienna, Herr Beyrich, of Berlin, and Prof. Gümbel, of Munich, presided over the three sessions which took place. Among the addresses were—"The Geological Constitution of the Harz," by Dr. Lossen, of Berlin; "The Fauna in the Older Deposits of the Harz and the Geological Position of the Hercynian Formation," by Dr. Kayser, of Berlin; "Phylogenetic Investigations in Phyto-paleontology," by Baron v. Ettinghausen of Graz, &c. Prof. Neumayr, of Vienna, gave an interesting report of his late trip through Greece, and exhibited the geological chart of North Greece, Thessaly, and Chalcis, based on his recent investigations.

THE administration of the Paris National Library inaugurated last Saturday a valuable addition to its internal machinery. A small pneumatic tube has been constructed to all parts of the building for conveying notes from readers asking for books. The new buildings erected on the site of the old lecture-room will be ready in a fortnight, and opened for public inspection. The space available for library purposes will be more than doubled by this addition.

THE earthquake of Monday week, to which we referred in our last number, extended from the Lago di Garda to Dijon, and from Strasburg to Grénoble.

THE French Society of Hygiene has just held its first monthly meeting at the Hôtel de la Société d'Encouragement, under the presidency of M. Chevalier, the eminent hygienist. M. Pietra Santa, the secretary, announced that the number of registered members of the new institution, modelled on the English pattern, amounted to more than 300. A letter from the Sanitary Institute announced that the Société d'Hygiène had taken a diploma of honour at the Leamington Exhibition.

THE Manchester Scientific Students' Association commenced its winter session yesterday, when a paper was read by Mr. Thomas Harrison, F.C.S., on "The Unity of the Senses," with experiments. Other papers to be read are by Mr. J. Plant, F.G.S., on "Silica;" Mr. William Gee, on "Telephones;" Mr. M. Stirrup, F.G.S., Notes on Auvergne—Puy-de-Dôme—Extinct Volcanoes; Mr. E. P. Quin, on "Vertebrate and Invertebrate Animals;" Mr. Robt. E. Holding, on a visit to the Zoological Society's Gardens, London; giving a description of some remarkable Animals and Birds—illustrated by diagrams from life; Mr. Geo. C. Yates, F.S.A., on "A Ramble amongst the Dolmens of the Morbihan."

THE annual *Conversazione* of the Whitehaven Scientific Association took place at the Town Hall of that town on October 9, when the president, Mr. R. Russell, C.E., F.G.S., delivered

the annual address before a large gathering. A practical exhibition of the telephone as well as an extensive display of late scientific inventions and objects illustrative of the natural history of the district, rendered the entertainment pleasant and profitable. The programme of the session for the next six months offers an attractive list of lectures, including a series of six from the president on Geology; six from Mr. A. Kitchin, F.G.S., on Light and Spectrum Analysis, and single lectures by fourteen other gentlemen. Among the titles we notice *The Chalk, its Origin, Characteristics, and Scenery*; *How an Animal is Built Up: Flowers, their Shapes, Perfumes, and Colours*; &c., &c. The Association is in a flourishing financial condition, owning a house of its own, and is not only popular but succeeds in infusing a healthful love for science into the district about. A library, a museum, and frequent field-days in the picturesque and geologically interesting neighbourhood, evidence the activity of the Society.

THE European Bureau of Longitude held its annual conference at Stuttgart, September 27, General Ibannez, of Spain, presiding. Representatives were in attendance from Austria, Bavaria, Belgium, France, Hesse, Italy, Norway, Prussia, Saxony, Switzerland, Spain, and Württemberg. Gen. Baeyer, of Prussia, was elected president for the coming year.

AT the meeting of the German Anthropological Society at Constance on September 24, Prof. von Virchow described the results obtained by him in his researches on the colour of eyes, hair, and skin of German school-children, and to which we have already referred. He examined no less than 2,114,153 children. In the whole of North Germany the fair, blue-eyed type with light skin is prevalent. In Mid-Germany the darker individuals become more numerous and reach their maximum frequency at the south-west and south-east corners. The passages from one type to another in a geographical sense are perfectly gradual. Upper Bavaria and Alsace are the extremes, between which the fairer type reaches southwards like a wedge.

AT the same meeting Dr. Gross, of Neuveville, on the Lake of Biel (Switzerland), exhibited a number of objects dating from the lake dwellings of the earlier stone period, amongst which some hatchets made of nephrite, a mineral now only found in China, were of special interest. Prof. Desor expressed his opinion that these relics were originally brought from Asia by the lake inhabitants; he believed it quite possible that they may have carried their valuables with them, and this hypothesis would explain the rarity of nephrite hatchets. A keen discussion was raised with regard to the discoveries in the Thayingen cave. It will be remembered that Herren Merk and Messikommer had found several bones from the prehistoric reindeer upon which drawings of animals were carved, besides a rough piece of sculpture representing the head of a musk buffalo. These objects are now in the Rosgarten collection, and many naturalists had believed them to be mere imitations. The result of the discussion, proved them to be perfectly genuine. This, however, is not the case with other pieces sent to France and England, and said to have been found at the same place.

A SPECIAL division of the Paris International Exhibition will be devoted to electricity, so that all the systems of electric lighting may be tested comparatively. The electric light continues to create the greatest interest in Paris. The experiments which we mentioned some time ago have been conducted during forty consecutive days at the Lyons railway station. A force of about 40 horse-power is sufficient to keep going twenty-eight electric lamps, each of which gives a light equal to eighty gas lamps, and works with regularity for ten and a-half hours. The effect is splendid, the whole of the station, except the waiting-room, being lighted *à giorno*. The question of economy, however, is not yet settled. It is not known whether the company

will agree to pay a somewhat higher price in order to multiply the power of its illumination. These experiments have been tried on Lontain's system, a modification of Wilde's and Siemens' principle. M. Lontain has contrived to send the current generated by an ordinary Wilde's machine into an electro-magnetic engine called a distributor. The central part being strongly magnetised by the current from a Wilde's machine, a number of electro-magnets are influenced by its rapid rotation, and in each of these an induction-current is generated. These induction-currents are powerful enough to feed three electric lamps, and as there are two series of twelve magnets a single machine could, theoretically, feed seventy-two lamps. Actually, however, it feeds only twenty-eight. Lontain uses a new regulator, which works very well by the dilatation of a small silver wire. By its dilatation this part of the apparatus works a lever system, and brings the carbon electrodes into contact. The French Northern Railway has purchased a number of Gramme magneto-electric machines. They intend to use them at their goods terminus and stores.

AMONG works of scientific interest announced for publication during the coming season we note the following:—Messrs. Macmillan and Co. are about to publish a new work by Prof. Clifford, F.R.S., "*Elements of Dynamics; an Introduction to the Study of Motion and Rest in Solid and Fluid Bodies.*" This book is intended for engineers and students of physical science who are unable or unwilling to devote much time to mathematics. Its method consists in making use of the simpler ideas of motion to teach so much of mathematical processes as is required for understanding the more advanced parts. Also, by the same publishers, "*An Elementary Treatise on Spherical Harmonics, and Subjects connected with them,*" by the Rev. N. M. Ferrers, M.A., F.R.S. Messrs. Longmans have just published of the London Science Class-Books Series, "*Astronomy,*" by Dr. Ball, and "*Thermodynamics,*" by Dr. Wormell. Other volumes to follow are "*Algebra,*" by Prof. Henrici; "*Botany,*" by Prof. McNab; "*Biology,*" by Prof. Kendrick; and "*Zoology,*" by Prof. McAlister. Messrs. Chapman and Hall promise two new volumes of "*The Library of Contemporary Science*"—"Biology," by Dr. Charles Letourneau and "*Anthropology,*" by Dr. Topinard. Messrs. Triebner and Co. announce: "*The Epoch of the Mammoth and the Apparition of Man upon the Earth,*" by James Southall; "*The Parthian Coinage,*" by Percy Gardner, M.A., and "*The Ancient Coins and Measures of Ceylon,*" by T. W. Rhys Davids, being Parts 5 and 6 of "*The International Numismata Orientalia*;" "*The Birds of Cornwall,*" by Edward Hearle Rodd; "*The Barents Relics,*" by C. L. W. Gardner; "*Chemistry in the Brewing Room,*" by C. H. Piesse; "*Origin and Migrations of the Polynesian Race,*" by Abraham Fornander, Circuit Judge of the Island of Maui; "*Dr. Beke's Discoveries of Sinai,*" by Mrs. Beke; "*A Statistical Account of Bengal,*" by Dr. Hunter. Mr. Stanford promises: "*Africa,*" edited by Keith Johnston, being the first volume of "*Stanford's Compendium of Geography and Travel,*" a work founded on Hellwald's "*Die Erde und ihre Völker*;" other volumes to follow "*Africa*" will be "*Europe,*" by Prof. A. C. Ramsay, "*North America,*" by Dr. F. V. Hayden, and "*South America,*" by Mr. H. W. Bates; "*Fifteen Thousand Miles on the Amazon and its Tributaries,*" by C. Barrington Brown and William Lidstone; "*The Physical Geography and Geology of Ireland,*" by Edward Hull; an English edition of M. De Fonvielle's "*Aventures Aériennes.*" Messrs. Kegan Paul and Co., successors to Messrs. H. S. King and Co., promise "*Hygiene and the Laws of Health,*" by Prof. Corfield; and of the International Series, "*Studies in Spectrum Analysis,*" by J. Norman Lockyer, F.R.S.; "*The Physical Geography of the Sea,*" by Dr. W. B. Carpenter, F.R.S., "*The First Principles of the Exact Sciences,*" by Prof. Clifford, F.R.S., and "*The Brain as an Organ of Mind,*" by Dr. Charlton Bastian,

F.R.S. Messrs. Blackie will publish a new edition of Thompson's "Gardener's Assistant, Practical and Scientific," revised and extended by Thomas Moore, F.L.S., Curator of the Chelsea, Botanic Gardens, &c., assisted by several eminent practical gardeners; also "Upper Egypt, its People and its Products," a descriptive account of the manners, customs, superstitions, and occupations of the people of the Nile Valley, the Desert, and the Red Sea Coast, with sketches of the natural history and ecology, by C. B. Klunzinger, M.D., formerly Egyptian Sanitary-Physician at Koseir on the Red Sea. Mr. Maclehoose, of Glasgow, announces: "Outlines of Physiology," by Prof. McKendrick; Messrs. Collins: "Building Construction," by R. Scott Brown; "Machine Construction," by E. Tomkins; and "Mineralogy," by J. H. Collins, in their Advanced School Series.

IN a paper in the *Journal de Physique*, on the spectrum of the electric spark, by M. Cazin, the author concludes that the electric spark in a gas contains incandescent gas particles, which give a bright line spectrum, and solid and liquid particles which produce the continuous spectrum, the former coming from the gaseous medium and the electrodes, the others from the electrodes and the sides near the spark. If the pressure increases, the solid or liquid particles become more abundant, and their continuous spectrum predominates; at last this makes it impossible to distinguish the bright gas lines, or, in other words, the latter, while the pressure increases, seems to dilate, and eventually flow together into one continuous spectrum. By making photographs of the spectra M. Cazin found his views confirmed. Of the nitrogen spectrum at ordinary pressure he photographed sixty-two lines, using nine cells in the battery giving the spark.

HERR J. STEFAN has lately communicated the results of some interesting researches to the Vienna Academy of Sciences, relating to the heat-conducting power of several substances. The conducting power of copper being taken as unity, he found that of iron to be 0.17, ice 0.0057, glass 0.0016, water 0.0015, hydrogen 0.00039, hard india-rubber 0.00026, and air 0.000055.

IN a recent communication to the Vienna Academy M. Ciamician discusses the spectra of chemical elements and their compounds. He finds, in agreement with Lockyer, that the compound spectra, as well as those of the first order of the elements, consist exclusively of bands; and further, that band-spectra belong to molecules and molecular groups, line-spectra to free atoms. From a comparison of the spectra of thirty-one elements he draws these conclusions: 1. The spectral lines of chemically-allied elements correspond to each other either individually or group-wise, so that each natural group of elements has its own spectrum, which, in the individual members of the group, is different only in that the homologous lines are displaced towards the one or the other end of the spectrum, *i.e.*, increase or decrease in wave-length, and that certain lines or line-groups disappear. 2. The increase or decrease of wave-lengths of homologous lines in chemically-allied elements depends on the intensity of their chemical *vis viva*, a greater wave-length corresponding to a greater chemical *vis viva* of the particular element.

ALTHOUGH for years there has been no scarcity in France through drought, still the want of irrigation is much felt almost every summer in the departments of the Mediterranean region. The French Government is about to take measures which might serve as a hint to the Indian Government. A project is being considered for taking advantage of the waters of the Rhone to irrigate systematically that large and already fruitful country. It is impossible to foresee what wonderful changes may result from such a scheme, which it is contemplated to bring into speedy execution.

THE Annual Report of the Queensland Philosophical Society, 1877, just received, is a satisfactory one. It contains the address

of the president, Sir James Cockle, on some of the aspects of the evolution theory.

THE second volume, for 1877, of Dr. Emilio Huelin's "Cronicon cientifico popular," has just been published at Madrid. In a recent number we gave a short notice of the first volume. The second volume is in every respect equal to the first.

THE additions to the Zoological Society's Gardens during the past week include two Bonnet Monkeys (*Macacus radiatus*) from India, presented by Mr. T. Golding and Miss Ward; a Layard's Flying Squirrel (*Sciuropterus layardi*) from Ceylon, presented by Sir Charles Peter Layard; a Brown Coati (*Nasua nasica*) from South America, presented by Dr. G. P. Best; a River Jack Viper (*Vipera rhinoceros*) from West Africa, presented by Mr. I. J. Kendall; two Red Kangaroos (*Macropus rufus*) from Australia, four Chinese Turtle Doves (*Turtur chinensis*) from Java, deposited; a large-billed Crow (*Corvus culminatus*) from India, purchased; a Vulpine Phalanger (*Phalangista vulpina*), born in the Gardens.

THE LIMITS OF NATURAL KNOWLEDGE¹

THE subject of my address was excellently treated at the Leipzig meeting in 1872, by Prof. Du Bois Reymond. If I take up the same matter again, I do so because I would consider it from a somewhat different and more universal point of view.

I shall also depart from the form and language in which the subject has hitherto been frequently treated. In its generality the theme easily induces the speaker to make excursions into the philosophical domain and to adopt the corresponding manner of expressing himself. I shall use words only of the simplest and clearest description, and I shall not suppose my hearers possessed of anything but a knowledge of the most elementary phenomena in the various domains of nature. In general matters expression is all the simpler and the more intelligible the closer our ideas approach clearness, and, at the same time, truth. I think it advisable, before entering upon the subject itself, to mention shortly the different ways in which the question of the limits of natural knowledge is generally conceived and answered by naturalists.

Amongst the so-called practical scientific men (*Praktiker*) the view is widely spread that a certain and lasting knowledge and understanding of natural phenomena is, on the whole, impossible. They know that hitherto their systems and opinions have not been permanent, and think that scientific theories generally are only attempts to approach the inaccessible reality, attempts which change their tenor and expression with the views of the time. This is evidently not a view based on principles, but only despair caused by failure, the necessary consequence of wrong method and of scientific incapacity.

The practical scientific man relies upon his experience, as he says. This, however, is gained in the following manner:—Each natural phenomenon is accompanied by different and often numerous causes and other circumstances. It is the task of the investigator to find out what are the effects of each one of these causes and circumstances; and this task cannot, in most cases, be accomplished by mere observation. The practical man then selects some cause or circumstance which happens to appear conspicuous to him, and in this he finds the fundamental cause of the phenomenon. This he calls his experience. We therefore understand how these practical men may hold different opinions upon the same phenomenon, why their views bear the stamp of the scientific epoch, and why in course of time they change. We also understand why the theories based on so-called experience are most fertile in those domains where phenomena are most complicated, as in organic morphology, in physiology, and pathology.

¹ Address delivered at the Munich meeting of the German Association, by Prof. C. von Nägeli, of Munich. (The author, in a note to the German original, remarks that this lecture had to replace another in the programme, which had been promised by Prof. Tschermak, of Vienna. At the eleventh hour Prof. Tschermak announced his inability to attend the Munich meeting, and the author was requested by the secretaries to fill the gap thus occasioned. The address therefore, the author states, bears the stamp of its hasty origin, as it was written during a journey in the Alps, when there was neither sufficient leisure nor opportunity for careful and elaborate work.)